

CARBON-MONOXIDE POISONING

1. The Disease Definition

Carbon monoxide is an odorless, colorless gas that can cause sudden illness and death.

A. Clinical Description

Carbon monoxide is harmful when breathed because it displaces oxygen in the blood and deprives the heart, brain, and other vital organs of oxygen. Large amounts of carbon monoxide can overcome a person in minutes without warning, causing loss of consciousness and suffocation. It may occur sooner in those most susceptible: young children, elderly people, people with lung or heart disease, people at high altitudes, or those who already have elevated carbon monoxide blood levels, such as smokers. Carbon-monoxide poisoning also poses a special risk to fetuses. It can be reversed if caught in time. However, even if a person recovers, acute poisoning may result in permanent damage to the parts of the body, such as the heart and brain that require large amounts of oxygen.

The most common symptoms of carbon-monoxide poisoning are headache, dizziness, weakness, nausea, vomiting, chest tightness and pain, and confusion. Sudden chest pain may occur in people with angina. Exposure to high levels of carbon monoxide can cause loss of consciousness and death. Unless suspected, carbon-monoxide poisoning can be difficult to diagnose because the symptoms mimic other illnesses. People who are sleeping or intoxicated can die before ever experiencing symptoms. If a carbon-monoxide detector sounds or a person experiences symptoms that could be carbon-monoxide poisoning, the person should leave the building immediately to get fresh and call 911.

B. Sources of Exposure

Carbon monoxide is found in combustion fumes, such as those produced by cars and trucks, small gasoline engines, lanterns, burning charcoal and wood, and any heating system or appliance that burns gas, oil, wood, propane or kerosene. Carbon monoxide from these sources can build up in enclosed or semi-enclosed spaces. Carbon-monoxide poisoning has occurred when vehicle engines are left running; when a home contains an incorrectly vented or malfunctioning water heater, furnace, space heater, fireplace or stove; and when charcoal, alcohol, or gasoline are burned in an enclosed tent or camper. In the workplace, people who work in boiler rooms, breweries, warehouses, petroleum refineries, pulp and paper production, and steel production are exposed to CO. The most common source of exposure in the workplace is the internal combustion engine.

C. Population at Risk

Everyone is at risk of carbon-monoxide poisoning. However, people with existing health problems, such as heart and lung disease, and the elderly are especially vulnerable. Infants, children, and pregnant woman are also at high risk. Each year, more than 500 Americans die from unintentional carbon-monoxide poisoning, and more than 2,000 commit suicide by intentionally poisoning themselves.

D. Diagnosis, Treatment, and Prognosis

The main reason to suspect carbon-monoxide poisoning is evidence that fuel is being burned in a confined area; for example, a car running inside a closed garage, a charcoal grill burning indoors, or an un-vented kerosene heater in a workshop. Under these circumstances, one or more persons suffering from the symptoms of carbon monoxide poisoning strongly suggests carbon-monoxide poisoning. In the absence of some concrete reason to suspect carbon monoxide poisoning, the disorder is often misdiagnosed as migraine headache, stroke, psychiatric illness, food poisoning, alcohol poisoning, or heart disease.

Concrete confirmation of carbon-monoxide poisoning comes from a carboxyhemoglobin test. This blood test measures the amount of carbon monoxide bound to hemoglobin. Blood is drawn as soon as possible after suspected exposure to carbon monoxide. Other tests useful in determining the extent of carbon-monoxide poisoning include measurement of other arterial blood gases and pH; a complete blood count;

measurement of other blood components, such as sodium, potassium, bicarbonate, urea nitrogen, and lactic acid; an electrocardiogram (ECG); and a chest x ray.

Immediate treatment is to remove victims from the source of carbon monoxide gas and get them into fresh air. If the victim is not breathing and has no pulse, cardiopulmonary resuscitation (CPR) should be started. Depending on the severity of the poisoning, 100 percent oxygen may be given with a tight fitting mask as soon as it is available. Rescuers may be exposed to fatal levels of carbon monoxide in a rescue attempt. They should be skilled at performing recovery operations and using recovery equipment. Employers should make sure that rescuers are not exposed to dangerous carbon-monoxide levels when performing rescue operations.

Taken with other symptoms of carbon-monoxide poisoning, carboxyhemoglobin levels of over 25 percent in healthy people, over 15 percent in patients with a history of heart or lung disease, and over 10 percent in pregnant women usually indicate the need for hospitalization. In the hospital, fluids and electrolytes are given to correct any imbalances that have arisen from the breakdown of cellular metabolism.

In severe cases of carbon-monoxide poisoning, patients are given hyperbaric oxygen therapy. This treatment involves placing the patient in a chamber, breathing 100 percent oxygen at a pressure of more than one atmosphere (the normal pressure the atmosphere exerts at sea level). The increased pressure forces more oxygen into the blood. Hyperbaric facilities are specialized, and are usually available only at larger hospitals.

The speed and degree of recovery from carbon-monoxide poisoning depends on the length and duration of exposure to the gas. The half-life of carbon monoxide in normal room air is four to five hours. This means that, in four to five hours, half of the carbon monoxide bound to hemoglobin will be replaced with oxygen. At normal atmospheric pressures, but breathing 100 percent oxygen, the half-life for the elimination of carbon monoxide from the body is 50 to 70 minutes. In hyperbaric therapy at three atmospheres of pressure, the half-life is reduced to 20 to 25 minutes. Although symptoms may subside in a few hours, some patients show memory problems, fatigue, confusion, and mood changes for two to four weeks after exposure.

E. Prevention of Exposure

To minimize the risk of carbon-monoxide poisoning:

1. Have furnaces and fireplaces inspected for cracks, gaps, rust, corrosion or debris by a qualified professional before each heating season. Fireplace chimneys and flues should also be checked and cleaned every year.
2. Have gas appliances serviced yearly by a qualified service technician. Stove burners should be cleaned and adjusted to minimize the amount of carbon monoxide produced. Gas dryer vents should be checked for lint buildup that may restrict ventilation.
3. Use non-electrical space heaters only in well-ventilated areas.
4. Never start or leave cars, trucks or other vehicles running in an enclosed area. Never leave the motor running in a vehicle parked in a closed garage.
5. Never operate barbecue grills indoors or use stove tops or ovens that operate on flammable fuels to heat a residence.
6. If living in a multi-family dwelling, be aware that carbon monoxide can enter your residence through floor boards, cracks, or underneath doors.
7. Never run a generator, pressure washer, or any gasoline-powered engine inside a basement, garage, or other enclosed structure, even if the doors or windows are open, unless the equipment is professionally installed and vented.
8. Use a carbon-monoxide detector. A detector can help alert you to increased levels of carbon monoxide in your home, but they are not foolproof. The Consumer Product Safety Commission recommends installing at least one CO detector per house, near the sleeping area. Homes with several sleeping areas require multiple detectors. For added protection, locate additional detectors at least 15 feet from the furnace. Look for detectors with the UL (Underwriters Laboratories) seal, and which feature an audible alarm.

2. Reporting Criteria

A. Disease Reporting

Carbon monoxide poisoning is reportable if:

- Blood carbon monoxide level equal to or greater than 10 percent carboxyhemoglobin or its equivalent in a breath analyzer test.
- A clinical diagnosis of carbon monoxide poisoning regardless of any test results.

Carbon monoxide poisonings must be reported within a week to the Iowa Department of Public Health Division of Environmental Health by the physician or health practitioner attending any person having a reportable disease and by laboratories performing tests identifying reportable diseases. Reporting can be through the Iowa Disease Surveillance System (IDSS), phone, fax, or mail. The preferred reporting method is through IDSS. To report via fax or mail, please use the Carbon monoxide poisoning Case Report Form available in the Epi Manual and online at

https://wiki.idph.iowa.gov/Portals/3/userfiles/12/Carbon%20Monoxide_Case_Report_Form.pdf

How to report to the Division of Environmental Health (Non IDSS Users)	
Phone (Mon-Fri 8 am-4:30 pm):	800-972-2026
Fax:	515-281-4529
Address:	Iowa Department of Public Health Division of Environmental Health Lucas State Office Building 321 E. 12th Street Des Moines, Iowa 50319-0075
24-hour Disease Reporting Hotline:	800-362-2736

B. Reference Sources

Iowa Statewide Poison Control Center

<http://www.iowapoison.org/prevention/common-types-of-poisoning/carbon-monoxide/>

Agency for Toxic Substances and Disease Registry (ATSDR)

<https://www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=253>

National Institute for Occupational Health and Safety (NIOSH)

<https://www.cdc.gov/niosh/topics/co-comp/>

Occupational Safety and Health Administration (OSHA)

<https://www.osha.gov/Publications/3282-10N-05-English-07-18-2007.html>